THE HAWKER ASSOCIATION

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EDITORIAL

To save costs the Committee would like more Members to opt to receive the **Newsletter by email** only. Please let the secretary, Dick Poole, know at <secretaryhawkercommittee@gmail.com>.

Christmas is creeping up on us so why not get your celebrations off to good start by booking for the Association Christmas Lunch? - details below.

Send your contributions to the Editor, Chris Farara at <cjfarara@gmail.com> or by post to 24 Guildown Road, Guildford, Surrey, GU2 4EN. Phone 01483 825955.

Happy Christmas to all our readers.

PROGRAMME FOR 2022 & 2023 (TBA: to be arranged, TBC: to be confirmed)

Wednesday November 9th	Chris Wilson - Jet Art Aviation
Wednesday December 14th	**Christmas Lunch**
Wednesday January 11th **2023**	Chris Roberts - Hawker Hunter for Kingston
Wednesday February 8th	Angela Bailey - Frank Murphy Part 2
Wednesday March 8th	Tony Buttler - Hawker flying Test-beds
Wednesday April 12th	AGM
Wednesday May 10th	Lambert Dopping-Heppenstal - subject TBA

Angela Bailey is Frank Murphy's daughter and has researched his life. **Chris Wilson is** the Managing director of Jet Art Aviation, providers of museum standard aircraft restorations. **Tony Buttler** is a leading aviation history writer. Lambert had a long and varied career at Kingston and Warton.

The Christmas lunch for Members and guests will be as usual at the Hawker Centre. The Menu will be slightly reduced (no starter) but still includes a glass of wine, desert and mince pies. Increased costs cause the price to be £20 this year. Lunch will be served at 1.15pm and attendees are requested to arrive from midday but not earlier, please. For further information and tickets contact Ken Batstone on 01932 229938 at 42 King's Road, Walton on Thames, Surrey KT12 2RA; cheques to be payable to the Hawker Association.

ASSOCIATION ONLINE VIDEO LIBRARY

Video recordings of Association talks can be found at http://easyurl.cc/HAVideoLibrary.

KINGSTON AVIATION CENTENARY PROJECT

David Hassard has completed his online history of the Sopwith Company and talks continue. He has been awarded the Aviation Heritage UK Lifetime Achievement Award for his work on the Project and associated activities - congratulations.

HUNTER XL623

The front fuselage was joined to the centre and rear sections on October 8th The team is congratulated on reaching this major project milestone. Winter preparations are now in hand.

AIRCRAFT NEWS

Sopwith: Tony Bianchi, provider of 'vintage' aircraft for film work, is selling many interesting projects including a Camel F1 part completed replica built from original drawings and a collection 1917 Pup parts with a complete set of drawings.

Hurricane: Hurricane XII, Canadian-built (RCAF)5481/G-ORGI, flew at Sywell in May following a lengthy restoration in Scone, New South Wales. On a sadder note, the only airworthy Hurricane IV, KZ321/OO-HUR crashed during a display at Cheb in the Czech Republic in August. The pilot, Peter Paces, was killed. The aircraft had formerly been operated by The Fighter Collection at Duxford as G-HURY.

Sea Hawk: Sea Hawk FGAMk6 WV908 has been delivered from storage at RAF Shawbury to the Fly Navy Heritage Trust at RNAS Yeovilton. Over the next couple of years it will be restored to flight status, in anticipation of which it has been registered G-

CMFB. (Why, I wonder? - Ed.) From 1989 to 1996 a complete restoration to flight status was carried out at Dunsfold.
Hunter: The first production Hunter FMk1,WT555 has been restored to display condition by North Weald Heritage Aviation for the Vanguard Self Storage company where it is suspended in the foyer of their building in Greenford, West London; for some years it was displayed on the roof.
Hawker P.1121: The Brooklands Museum awaits confirmation that its bid to the RAF Museum for the uncompleted airframe (fuselage and one wing) of this Mach 2 fighter has been accepted.
Harrier: GRMk3, XV808, bought by Mr Roy Millington in 2012, was restored by him and his son with help from volunteers. It is kept in taxiing condition on the Millington's farm in Shropshire where Millington Engines are produced for motor racing of all types
Sea Harrier FA2: Jet Art Aviation has purchased three ex Culdrose aircraft ZH798, ZH804 and ZH811. ZH798 has been restored to taxiing condition and is for sale.

BUILDING CONCORDE

On September 14th the well known aviation author, Tony Buttler, once again spoke to the Association, this time on the creation and development of Concorde.

Starting at the very beginning Tony noted that the first design for a supersonic transport (SST) was a 1946 Miles project for a 20 passenger aircraft but the UK Concorde story really started with the establishment in November 1956 of the Supersonic Transport Aircraft Committee (STAC), under the chairmanship of Morien Morgan of RAE Farnborough's Aerodynamics Department. Morgan had worked on supersonic flight and design for some years. The cruising speed range considered by the STAC stretched from Mach 1.2 to Mach 2.6.

STAC funded research and proposals from several British manufacturers which responded with a variety of projects among which was the Bristol Type 198, really the origin Concorde. Having studied the proposals the STAC's strong recommendation, made in March 1959, was that project design should start on two SST's: non-stop London to New York at Mach 1.8-2.0 and a shorter range aircraft for Empire and European routes with a cruise speed of Mach 1.2.

This prompted a further round of more concrete proposals: the Bristol 198 of September 1959 to cruise at Mach 2.2 at heights above 51,000ft and carry 136 passengers, the Handley Page HP.128 to cruise at Mach 1.15 at 36,000ft with 125 passengers, and the Vickers variable sweep Types 586 and 587 carrying 80 passengers at Mach 2.5 at altitude. The Hawker Siddeley Advanced Project Group's (HSA APG) Type 1000 was a strong rival to Bristol's studies for an SST. It was a 100 seat integrated wing project designed initially to cruise at Mach 2.2, though further studies went on to look at Mach 2.7. The HSA APG also looked at the transonicType 1011, a Mach 1.15 aircraft with 160 passengers. But Hawker's main proposal was the Type 1000. Indeed, during 1960 the two main 'contenders' were the Bristol 198 and the HS 1000; RAE Farnborough and the Ministries undertook a detailed review of the two designs. However, by September 1961 it was decided that the Bristol 198 (or BAC 198 after the mergers) should continue scaled down as the BAC 223 looking much like Concorde, with four Olympus 593 engines.

A key area was finding a 'supersonic wing', and the principal research was at RAE Farnborough by aerodynamicist Dietrich Küchemann, working closely with Johanna Weber. They had worked together at the German aerodynamics research institute at Göttingen during the war. They made major contributions to the advance of high speed aerodynamics and flight, in the fields of drag, swept and delta wings and fuselage design. In the slender delta wing the aerodynamicists found a shape that was not only ideally suited to economic supersonic cruise but also had a lifting capability at low speeds that far exceeded expectations. Another advantage was the magnitude of additional lift generated by the proximity of the ground during lift off and at touch down. Key was the generation of a stable system of leading edge vortices. The resulting Concorde wing was a subtle 3-dimensional shape. This field of aerodynamics was also the subject of researched in France at ONERA (Office National d'Etudes et Recherches Aérospatiales) and in America by NACA (the National Advisory Committee for Aeronautics).

There was also the kinetic heating problem to be solved. At Mach 2 the stagnation temperature increase is 175°C. Above 37,000ft in flight at Mach 2 temperatures on parts of the airframe could reach 120°C because of the low outside air temperatures. This was acceptable for certain aluminium alloys and required only relatively modest development work in terms of strength properties allied with a long service life. The UK's High Duty Alloys undertook a major development programme to perfect an alloy called RR.58, which was used for most of Concorde's airframe.

Meanwhile France had also been working on SSTs and in 1958 Sud Ouest and Sud Aviation produced brochures, Sud's being called 'Super Caravelle'. In May 1959 the STAé (the body responsible for coordinating all aeronautical study and research in France), ONERA (the French aerodynamic research establishment with numerous wind tunnels.)led by Philippe Poisson-Quinton and the manufacturers met to discuss the interest and possibilities for pursuing an SST. The eventual outcome was a 3-way design competition between Dassault, Nord and Sud.

By April 1961 Sud Aviation's Super Caravelle studies looked similar to the Bristol 223. It used four Rolls-Royce RB.169s to cruise at Mach 2.2 at 55,000ft carrying some 90 passengers.The Super Caravelle was first displayed publicly as a project at the May 1961 Paris Show. Meanwhile negotiations were ongoing between Britain and France for a joint programme, and in January

1962 the British Aircraft Corporation and Sud Aviation proposed a joint slender wing light alloy project designed to cruise at Mach 2.2 powered by four Bristol Siddeley Olympus 593s.

On 29 November 1962, an agreement between the governments of France and Britain was signed by Britain's Minister of Aviation, Julian Amery, and France's Ambassador to the UK, Geoffroy de Courcel. A work share was agreed between BAC, Sud Aviation, Bristol Siddeley and SNECMA for the airframe and power plants with the systems provision shared between the two nations.

The name Concord, or Concorde in French, was confirmed shortly after the agreement had been signed, but it was not until December 1967 that Concorde with an 'e' was officially adopted by the British. The word means 'agreement or harmony or union between people or groups' However, many in UK politics, the Treasury and in industry did not think the project was viable and the British Overseas Airways Corporation (BOAC) also had concerns. Deeply involved in the Concorde negotiations were Sir George Edwards, managing director of BAC and Sud chairman and MD General André Puget. The chief designers were Archibald Russell at BAC Filton and Pierre Sartre at Sud Aviation, soon to become part of Aerospatiale.

Tony went on describe important elements of the design and development programme including the certification of a slender delta without a definite stall - the zero rate of climb speed was used. The droop nose which protected the windscreen from kinetic heating at high speed and gave a satisfactory pilot view for landing was devised, as was fore-and-aft fuel transfer to maintain the correct centre of gravity to centre of pressure relationship at sub- and supersonic speeds. The variable intake was designed to feed the Olympus 593 engines with air at the required M 0.5 in flight at M 2.2 and also, by using spill doors, to cope with two engines on one side shutting down together. Noise at take-off and the sonic boom in cruising flight were unsolved problems which led to supersonic flight over land being prohibited thus adversely affecting Concorde's commercial success.

Several research aircraft were involved in the programme. In the UK the BAC.221, a Fairey FD 2 rebuilt with a slender delta wing, explored high speed handling while the slender delta HP.115 explored low speed handling. Vulcan XA903 flew with the Olympus 593 in an under-fuselage nacelle with a representative intake. In France a variable stability fly-by-wire Mirage IIIB was used to simulate Concorde flight characteristics and train the test pilots. Mirage IVs were used to simulate Concorde in civilian traffic patterns and to allow the test pilots to experience flying a large delta for prolonged periods close to M 2.

Construction of the two Concorde prototypes began in April1965. The first flight of 001 (F-WTSS) by Aerospatiale Chief Test Pilot (CTP) Andre Turcat was on 2 March 1969 at Toulouse. The first flight of UK Concorde 002 (G-BSST) by BAC CTP Brian Trubshaw was on 9 April 1969 from Filton to Fairford, the base for the British flight test programme.

Tony went on to cover other Concorde achievements but to see these and a much fuller exposition of the above summary visit the Association on-line video library by going to http://easyurl.cc/HAVideoLibrary

RAF HERCULES IN-THEATRE OPERATIONS DURING GULF WAR I

On October 12th Group Captain Peter Bedford spoke to the Association. Chris Roberts introduced him saying that his early life was at Primemeads Farm, Dunsfold Aerodrome,when his father, Bill Bedford, was Hawker's Chief Test Pilot. At 18 he joined the Royal Air Force via the RAF College Cranwell and after his first tour on the C-130 Hercules he trained as a qualified flying instructor. He flew the aircraft in all roles, specialising in low level and air-drop, including operations with Special Forces, and in 1982 pioneered the introduction of air-to-air refuelling for use in the Falklands War. In 1991, during the First Gulf War, he commanded the Air Transport Detachment (ATD) at Riyadh throughout the air and ground wars, the subject of his talk.

Peter started by saying that many are generally familiar with what happened when the UK was involved in operation Granby/Desert Storm to oppose Iraqi President Saddam Hussein's invasion of Kuwait on August 2nd 1990, but perhaps not with the role played by the RAF's Air Transport Force (ATF). This comprised 19 VC-10s and Tristars from Brize Norton and Lynham's 56 strong Hercules force which conducted the bulk of the tasking, with in-theatre operations starting in November.

At the time Peter was serving at Lyneham as OC 242 Operational Conversion Unit. From August 1990 he flew intensely on the Granby routes through Cyprus and further east. In January 1991, he moved to command the ATD at Riyadh/King Khaled International Airport (KKIA), Saudi Arabia, remaining in post until March. The ATD was formally established in November based in empty rooms in the unfinished Terminal 4.

KKIA was a 'hub', fed by daily Tristar flights, with the three deployed Hercules providing the in-theatre 'spokes' around the Gulf, re-supplying British forces at a wide variety of locations. The Royal New Zealand Air Force provided a welcome addition with two aircraft and three crews plus support elements, from 40 Sqn, Whenuapi, Auckland. As further UK deployments continued, in mid-January 1991 the detachment at KKIA was increased to seven RAF Hercules and 14 crews, with an additional engineering, movements, supply and support staffs. With the RNZAF the overall combined detachment was around 260.

One of the problems at KKIA was ramp space. The ATD was sharing facilities with civil and military operators from many nations - including France. On arrival Peter found that there had not been much success in sorting out use of ramp space between the RAF Hercules and French C-160 Transalls. Happily it transpired that Peter knew the detachment commander from an exchange posting in France so the language barrier evaporated and quickly the problem was solved!

Events moved swiftly and on 17 January, operation Desert Storm commenced and all out-of-theatre ATF and civil charter

flights were suspended. On February 28th the air campaign began and within 12 hours requests for airlift began flowing in to HQ British Forces Middle East (BFME), also in Riyadh. The first sorties were flown on 18 January, just one day after the start of the air campaign.

Much preparatory work had been done, especially crew training on desert low-level flying and natural strip landing, including at high all-up weights. However, many crews were either out of currency or were untrained in such skills so training was co-ordinated via a Mission Planning Cell, made up from an in-theatre crew, dedicated to this task. Their work included setting up an intelligence cell, the updating of crew in-flight operating guides and the establishment of Air Transit Routes (ATRs) in the overall Airspace Control Order. This latter aspect was vital, since not only did it enable the Hercules to operate to all Gulf locations, but it also de-conflicted these flights from the many thousand flown daily by coalition fast jet forces.

In the cell was an experienced captain who had completed an exchange tour with the USAF and had spent many years with the RAF Hercules Special Forces. This gave him a wide understanding of USAF tasking procedures - a skill which proved to be fundamental to ATF operations during Desert Storm. In another coincidence an American friend of Peter's, from his time on exchange, was Deputy Chief of the USAF Airspace Co-ordination and Planning team, and he was thus able to have unofficial, but vital, advanced access to the air campaign maps and procedures.

Regarding aircrew procedures the use of ATRs was the major change affecting the aircrew after the transition to wartime procedures. The ATRs were operated under visual flight rules only, with strict limitations on navigational accuracy to remain within the necessary lateral bounds - plus or minus 2 nautical miles. A further complication was that they were available at one level only, with two-way traffic separated laterally, including at night. Poor en route weather would require a 180 degree turn and a lost mission. However, throughout Desert Storm only one sortie was lost due to weather out of more than 1300 flown. Helpful, in the event of bad weather, was the availability of low-level aeromedical evacuation routes. On many occasions the weather was not good; it was one of the wettest periods in the region ever.

A difficulty was the limitations of the Hercules avionics fit, with all navigation aids turned off above 27 degrees north. The aircraft had no suitable internal aids and was not fitted with Mode 4 IFF (Identification Friend or Foe). Hence the basic technique of map, compass and stopwatch was used. Lack of Mode 4 IFF was a concern on safety grounds, since it was the primary means of identifying friendly assets and the Hercules was one of the few aircraft without it. There was concern about the possibility of 'blue on blue' engagements, considering the intensity of air operations, with more than 100,000 sorties being flown during the entire 6-week air campaign; an average of over 2,000 per day.

In the broader picture, the ATD operated to a wide variety of bases in the Gulf and Saudi Arabia, and to many lesser-used airfields. Also use was made of an old oil company semi-prepared strip, 4,000 feet long and 60 ft wide, with a tyre-consuming flinty surface. However, it provided a convenient lifting-off point for over 7,000 troops of the British Armoured Division, moving them towards their forward location whence they were transported by Chinook helicopter nearer the Iraqi positions. 'Combat loading' was used, where the freight bay was left empty of seats and the troops sat on the floor . Restraint was by strops across the fuselage which the troops pulled over themselves as they sat down. This RNZAF technique enabled the customers to enter and exit quickly and gave the flexibility to load vehicles and other freight.

Low level flying became routine, operating on the 'pipeline route' and, given the strip operations and the demands of bad weather and sandstorms, the crews became expert in a wide variety of skills. After hostilities broke out it became evident that all Hercules crews should be low-level and strip qualified, and the aircraft had to be strip-prepared with, for example, under-body protection and reinforced tyres.

In parallel was a major effort to build up the expertise on aero-medical evacuation. This plan catered for 1,000 allied casualties per day but, thankfully, it was never used and all tasks were dealt with on a reactive basis and numbered less than a dozen flights in all. Two more dirt strips were trialled, one adjacent to two field hospitals and the second close to the rear elements of the British Armoured Division. This second strip became the scene of hectic movements as last-minute supplies were flown in. Also conducted was a trial air drop just a few hundred metres to the west of this strip, using the expertise of our air despatch personnel. All went well, but again, this capability was never used in anger.

On the last day of the ground campaign, the ATD Hercules flew two of the first fixed-wing missions into Kuwait city, the first bearing the keys to the British Embassy and the second carrying the Ambassador himself.

Peter then turned to the special forces (SF) Hercules of 47 Sqn, which deployed into theatre early in the operation, and were independent of the ATD. These were fitted with Mk 4 IFF, and limited self-protection equipment - but did not have a sophisticated avionics fit – they, also had very good navigators! They trained with their SF ground-based customers and practiced other skills such as strip landings, by day and night, fighter evasion and the rapid loading and unloading of troops and vehicles. Ultra low-level flying was another necessary skill, and was conducted also at night, but this proved difficult over desert terrain since starlight gave insufficient illumination whereas the reflections from a full moon were too bright. Thus, the useful period for safe night vision goggle operations was limited. However, numerous re-supply runs were conducted and the first Iraqi prisoners of war were flown back to Riyadh. Also, during the retaking of Kuwait, troops and communications equipment were transported to Kuwait airport. Routing at low level, through the burning oil fields, the first crew arrived to find the runway completely undamaged.

However, fuel supplies at the airport were contaminated so the crew were quickly involved in Forward Air Refuelling Procedures, or "farping". Over the course of a few hours, the crew dispensed fuel to over 20 coalition helicopters enabling them to continue with ongoing operations. Without going into further detail, suffice to say that the SF crews were able to perform a wide variety of demanding tasks and were a key element of Hercules involvement in Granby.

Anyone who flew into Kuwait immediately after the ceasefire was met by the nightmarish scenes of burning oil wells and the wanton destruction on the ground. Descending below 5,000 ft one went suddenly from clear blue sky into pitch black and all the cockpit lights had to be turned on. Break-through happened at around 3,000 ft, and there lay the oil fires. The ferocity with which they were burning, the amount of smoke that was being pushed out, and the sheer number of fires, right across the horizon, was almost incomprehensible. Indeed, over the coming weeks, the pollution became much worse and at times the runway was not seen until very late on finals.

On the ground everything in and around the terminal that could not be looted was either broken or vandalised and there was a great danger of unexploded ordnance. Also amongst our own forces there were issues regarding 'trophies'. There were even tales of live hand grenades being sent back by the troops to Germany via the BFPO (British Forces Post Office). Not surprisingly, General Sir Peter de la Billière, Commander-in-Chief British Forces Middle East, issued a strict edict that trophies were not to be brought back from Kuwait or Iraq. Just after the ceasefire, an ATD Hercules flew him into Kuwait City airport, along with the UK Defence Secretary, Tom King. After conducting his business, Sir Peter came back in one of the New Zealand Hercules,and as he stepped onto the aircraft he looked back into the freight bay and saw a huge Iraqi ant-aircraft gun; somehow the Kiwis managed to talk themselves out of this 'offence'. Peter found out later during a trip to New Zealand that they had managed to hide the gun at Riyadh, aided and abetted by UK military forces!

In conclusion, Peter said, the overall achievements of the combined RAF/RNZAF detachment at Riyadh were impressive. He showed slides of statistics which reflected great credit on the ATD engineering, movements and support staff who did a marvellous job in sustaining the work rate, both in maintaining the airframes and coping with the vast flow of troops and freight. The operations staff and aircrew showed great flexibility in dealing with a wide variety of tasks, often under very trying circumstances. Indeed, this was a team effort and co-operation between all elements was outstanding. Morale was high and the team responded tremendously well to the many demands placed upon it. And finally, the Royal New Zealand Air Force element performed superbly, and integrated effectively, wholeheartedly and with boundless enthusiasm.

On March 23rd 1991 Peter returned from KKIA to Lyneham. On arrival he flew a circuit at 500 feet, banking gently over Arrivals Terminal, landed and taxied slowly in with Union Jack flying to be met by Station Commander, families and champagne! It was good to be home after a memorable ten weeks away!

The vote of thanks for this excellent and enlightening first hand account was given by Frank Rainsborough. To see a much fuller exposition of the above summary visit the Association on-line video library by going to http://easyurl.cc/HAVideoLibrary

'PHANTOM DIVES', FORMATION FLYING NEAR THE STALL; AND LITTLE BLUE MEN

Trevor Davies, Flight Test Engineer and Observer, and Project Designer T-45,recalls flight testing at Dunsfold leading to some interesting aerodynamic developments on the Hawk….

When I left university I went to work for Hawker Siddeley Aviation at Dunsfold in Flight test Services. Initially I was involved in analysing Harrier handling trials data and then a systems trial before, in 1974, being made responsible for managing the flight trials of the first Hawk T Mk 1, XX154. During one of the early test-flights, a preliminary assessment of the low-speed handling in the approach configuration i.e. undercarriage down and flaps fully down, was being carried out by Chief Test Pilot Duncan Simpson. On completion of one test he applied power and, unusually, retracted the undercarriage with the flaps fully down, to accelerate the aircraft only to find, to his surprise and consternation, that the nose of the aircraft pitched down into a dive, a motion that could not be countered even with the control column pulled fully back. With no obvious reason for the behaviour he adopted the philosophy of reversing whatever actions he had done last; he extended the undercarriage. This immediately restored normal pitch control for a safe return to Dunsfold.

In the post-flight discussion this phenomenon became referred to as the 'Phantom Dive' – and no, I can't remember why. In this particular instance it had occurred at around 20,000ft, which had given Duncan the opportunity to resolve the situation but if it were to occur in close proximity to the ground, such as during a landing overshoot, it would have catastrophic results.

The aerodynamicists Harry Fraser-Mitchell and Barry Pegram were called in and concluded that the tailplane had stalled because of its increased negative angle of attack due to the airflow aft of the wing being deflected downwards – downwash. This is normally present behind a wing but the effect increases as the flaps are extended. In this case the amount of downwash due to full flap had caused the tailplane to stall. But what had suddenly triggered it? Again they had a possible explanation. Initially the undercarriage had been down which would have shed a wake onto the flaps and reduced their effectiveness and consequently the amount of downwash. When the undercarriage was retracted this wake was removed increasing the downwash sufficiently to cause the tailplane to stall. The subsequent lowering of the undercarriage restored the wake, reduced the downwash and un-stalled the tailplane, allowing pitch control to be regained.

Subsequent flight tests proved this to be the case. With the undercarriage down there was no tailplane stalling while at the same conditions it could be provoked simply be retracting the undercarriage. Extending the undercarriage would then restore pitch control. We now had an understanding of what had happened and also a more accurate name for the phenomenon – tailplane stalling – which is what it was known as from then on. This still left the question of what to do about it.

The solution turned out to be very simple. The parallel chord Hawk flaps had a full span vane supported on a number of brackets protruding from the leading edges of the flaps. Removing a section of the vane would reduce the effectiveness of the flaps and hence reduce the associated downwash. The section between the two outboard brackets, about one sixth of the span, was therefore lopped off as it was the most heavily loaded aerodynamically. This 'cut-back flap vane' was trialled to see if it was enough to resolve the problem; it was! The reduced flap effectiveness had a consequent effect on landing performance, requiring slightly higher approach and landing speeds, but this was still comfortably within the landing performance required by the Ministry of Defence (MoD) Hawk contract. The 'cut-back flap vane' thus became the standard for all Hawk T Mk 1s and export Mk 50s and 60s.

At the end of the 1970s the US Navy published its requirement for a new pilot training system, known as the VTXTS, and BAe, as we had become, teamed with the Douglas Aircraft Company (DAC) to propose a system based on the Hawk. The Navy requirements meant that the Hawk would have to be modified for aircraft carrier take-offs and landings. Strengthening the Hawk for this task meant a significant increase in weight which, together with a particular carrier landing approach requirement, known as a 'glide slope transfer manoeuvre' was causing some concern.

By this time the Hawk was being developed as a ground attack aircraft carrying increasingly heavy external store loads. The airframe itself was also being further developed to incorporate a suite of more modern avionics, to become known as the 100 Series, with a consequent increase in aircraft weight. A means was therefore needed to mitigate the impact of these on approach and landing speeds. We needed the full span flap vane back!

Were this to be done on the back of the T-45TS contract, as the VTXTS had by then been named, BAe would have had to pay royalties to the US Navy for sales to other customers of any aircraft incorporating the solution. It was decided therefore that BAe would privately fund the development so that they would retain the rights to it and could hence use it royalty-free on any future Hawk variants.

While the aerodynamicists had ideas of potential solutions they needed a more precise understanding of the magnitude of the downwash and its impact on the tailplane. Previously, to understand airflow behaviour on the wing, we had used 'tufts', lengths of parachute cord about 12 – 15 cm. long anchored at one end to the wing surface with adhesive tape (yes, it did work!) and filmed from cameras mounted in the rear cockpit looking outboard.

Tufting the side of the rear fuselage and underside of the tailplane was no problem but how were we going to film them? There was no place to mount cameras on the aircraft that would give an adequate view. We had used a chase aircraft from which to film weapons separation trials on many occasions so the question was asked: could we do the same to film the tufts? The difference was that weapons trials took place in a stable flight regime at fairly high speeds whereas tailplane stalling occurred with the test aircraft not entirely under the pilot's control in pitch and with both aircraft flying at a speed not much above the stall. After a bit of careful thought by Flight Test, the Test Pilots and Aerodynamics, it was decided that it was feasible but might take a bit of getting right.

A full-span flap vane was therefore fitted to Hawk T Mk 1 XX338 and the appropriate areas of the fuselage side and tailplane were tufted. For the test flight XX338 was flown by Jim Hawkins accompanied by chase aircraft XX154 flown by Andy Jones with me and a 16mm ciné camera in the rear seat. The objective was to set the two aircraft up, with undercarriage down and flaps fully down, in formation where the camera would have a clear view of both the fuselage side and underside of the tailplane of XX338. For safety's sake this couldn't be too close, given the expected behaviour of XX338, but too distant and the tuft movements would not be clear in the film. Once ready, Jim retracted the undercarriage of XX338 and then Andy's job became one of holding formation on another aircraft with a stalled tailplane by flying one that was at not much above stalling speed itself, while keeping it as stable as possible. This would then give me a chance of keeping the back end of XX338 not just in the camera frame but steady enough to be able to see what was happening to the tufts. The quality of the film we produced was testament to Andy's flying skills.

The aerodynamicists now had the more precise understanding that they needed and Barry Pegram devised some 'tailplane vanes'. These were small, almost triangular surfaces the long axis of which ran parallel to the axis of the fuselage, with the apex forward, and with curved outer edges. They projected normal to the fuselage surface at a position where the vane trailing edge lined up with the leading edge of the tailplane when it was in the fully leading edge down position. In flight it was expected that at higher speeds the tailplane vanes would have no effect but at low speeds the shed vortex from the outboard edge would energise the airflow passing under the tailplane and enable it to remain attached to the under-surface, thus preventing the tailplane stall. Flight tests subsequently proved this to be the case and tailplane vanes became a feature not just of the T-45A Goshawk (as the US Navy's official designation became) but of all 100 and 200 series Hawks.

Having been successful in securing the US Navy contract we were, under the terms of that contract, required to provide

verification of all aspects of the aircraft's design to the US Navy Project Team, although this did not affect BAe's rights to the non-T-45 specific design aspects, including the tailplane vanes. This verification had to be presented at both a Preliminary Design Review (PDR) and a Critical Design Review (CDR). By the time of the PDR, I had moved to the Design Department at Kingston as Project Designer T-45 and as such was involved in both these Reviews.

Prior to the PDR the USN Project Team had been made aware of the incorporation of the tailplane vanes into the T-45A design and why. A letter was subsequently received from the US Navy acknowledging this and stating that, for the US Navy contract, these were designated Side Mounted, Unit horizontal tail, Root Fins - SMURFs! Given that in those days the Smurfs were popular childrens' TV cartoon characters this designation produced a bit of bemusement within BAe; until someone noticed the date on the letter – 1st April - Yeah, right!

At the subsequent PDR the US Navy Project team was given a more comprehensive explanation of the tailplane vanes and updated on progress to date. At the end of this a very unhappy US Navy Project Manager had a sense of humour failure and demanded to know why we were referring to tailplane vanes and not using the official SMURF designation - Oops!

A copy of the letter was quickly produced and the date and its implications pointed out. The misunderstanding was simply explained. You have to remember that in those days (before every desk had a computer on it) letters were hand-written and then passed to a typing pool for production of the formal version. This letter had been written in the final days of March and then passed to the typing pool. There it had been typed up on 1st April and dated with that date, something that had not been noticed when it was returned to the writer for signature and despatch. Fortunately the Project Manager now saw the funny side of it and, as we promised to correct the designation, the normal very good relationships were restored.

At the CDR we had the final design information and results from both high-speed wind tunnel and full envelope flight tests to present. The format of the overhead-projector slides (this was pre Powerpoint) for the Reviews was to have a title bar at the top flanked on one side by the T-45 project logo and on the other by either the BAe or DAC logo, dependent upon which company had design responsibility for the particular aspect. For the 'SMURFs' presentation we decided to introduce a little levity by replacing the BAe logo with the face of one of the well-known little blue men – a grumpy one for the explanation of the initial issue and a happy cheering one for the slides presenting the solution. Our DAC colleagues were decidedly worried about the reaction from the US Navy but as there was not enough time to produce alternatives we had to run with what we had. As it turned out the fears were unfounded as the presentation was the trigger for smiles and a couple of quiet sniggers from the US Navy Project Team.

Editor's Note: the Phantom Dive name came, I believe, from McDonnel's F-4 Phantom which at one time also experienced tailplane stalling. The SMURFS were devised by Barry Pegram who, because of his beard, became known as Papa Smurf.

BOOK REVIEWS

Harrier: How to be a Fighter Pilot by Commander Paul Tremelling; Michael Joseph; 6 ¼ in x 9 ½ in (250mm x 160mm); hardback; 358 pages; illustrated; £20. ISBN 978-0-241-55705-1.

After training on the Hawk Cdr Tremelling flew the Sea Harrier FA2 and the Harrier GR9 for the Royal Navy, and the F/A-18 Super Hornet on a posting to the United States Navy. He took part in numerous realistic air exercises as well as real bloody warfare with all of the risks that this entails. The book is illustrated with many previously unpublished and personal photographs.

His book is not about flying but about operating naval fighters in air-to-air roles from ships, and close air support fighters against ground targets. He describes in a vivid fashion how the fighter pilot does his job by skilfully using the navigation , attack, communications and defensive systems he is provided with to find and bring maximum harm to his enemies with the array of weapons available to him. He also describes taking off by day and by night in all weather conditions as a prelude to the attack and the safe return to his base, be it heaving ship's deck or chokingly dusty runway. The excited reader is taken on the sortie which must be the next best thing to actually being there.

He writes particularly well about finding and ruthlessly attacking Taliban in Afghanistan and saving allied ground troops from falling into their cruel hands. Sadly Cdr Tremelling concludes that, after the untimely withdrawal of allied forces, the war had been a "complete waste of life, blood, tears and time", not to mention the billions of dollars and pounds expended.

Although this is a serious book it is written in a very readable style, leavened with wit and humour. The reviewer was involved in the development of the Harrier from pioneering prototype to mature fighting aircraft and I treated the job, as I suspect many of my colleagues did, as an intellectual exercise. I knew it was a fighter but I really had no concept of what that meant in practice to the men who flew them into battle. Now I think I do.

The Aviation Historian, Issue 44, includes fascinating 'Hawker' articles: Matt Bone and illustrator Ian Bott examine the rocket firing Typhoon and its RP-3 rocket projectiles; Dr Tim Jenkins recounts a little known non-stop 1927 long distance flight by an RAF Horseley which flew a record 3,420 miles from Cranwell towards Karachi, ditching before it got there - however this was immediately overshadowed by Lindbergh when he landed at Paris after covering some 3,600 miles; and Peter Lewis details the lengthy but fruitless Swiss evaluation of the LTV A-7 Corsair II leading to the purchase of more Hunters. Also, Prof Keith Hayward completes his Comet saga with the Comet 4 story and J-C Carbonel describes the evaluation of the Short SC-1 by French intended

VTOL test pilots.

The recently remaindered **'Hawker Siddeley Harrier - the World's First Jump-Jet'** by Mark A Chambers, "a contractor for NASA Langley", gets my prize for the worst written Harrier book ever. It also contains numerous errors, including the title. However, in spite of this, it is well presented and does have some value in that it contains many photographs of American origin, including P.1127 model testing at NASA Langley, not familiar to UK readers.

MEMBERSHIP NEWS

Sadly we record the death of Mike Laker and send sincere condolences to his family and friends. We welcome new members Ken Clacher and Lewis Gaylard. Geoff Fieldus, Cliff Douthwaite and Chris Nicholson have left the Association.

Membership List - November 2021

The list below is what the Committee believes to represent the current membership. If you disagree in any way please let the Editor know. **Subscriptions for 2022 - 2023 (£7) are overdue from those in bold below.** Please send cheques payable to The Hawker Association to the Membership Secretary, Diana Dean, Virginia Lodge, 125 Glaziers Lane, Normandy, Surrey GU3 2EA. If you have paid by BACS and this information has not reached our records; apologies. Long term non-payers have been deleted.

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